Organ procurement and preservation: what is new and what is established?

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This section of *Current Opinion in Organ Transplantation* addresses important issues in organ procurement and preservation as well as optimal donor and recipient management to minimize allograft injury linked to organ preservation, ischemia and reperfusion [1]. The mechanistic understanding of ischemia/reperfusion injury (IRI) has shifted during the past two decades from a pure pathobiochemical model to a two interrelated phase model of local ischemic insult and innate inflammatory immune response upon reperfusion. The better understanding of immunological events during brain death in deceased donors and after graft reperfusion is critical to design immune-specific therapies to minimize IRI. But also optimal donor management and anesthetic strategies during the transplant procedure and early postoperative course are important elements to protect allografts and improve outcome of recipients.

The introduction of University of Wisconsin solution in 1987 has revolutionized organ procurement by safely increasing the duration of organ preservation. The impact of University of Wisconsin solution on organ procurement is probably comparable with the impact of cyclosporine on liver transplantation. Parson and Guarrera [2] review the current status of preservation solutions for static cold storage. Although other effective preservation solutions, such as histidine–tryptophan–ketoglutarate, Celsior, and Institute George Lopez-1, have been developed and successfully used in visceral multiorgan procurement, University of Wisconsin solution remains the most popular preservation solution for kidney, liver, pancreas and intestine procurement today. A recently published meta-analysis demonstrated that there is currently no evidence of the superiority of one preservation solution over another in terms of post-transplant outcome [3].

Another topic of the journal section was 'Where to cannulate and how to perfuse' during multiorgan procurement [4]. There are two types of vascular access for abdominal organ flushing: cannulation of the arterial system only (infrarenal aorta, iliac artery) or dual cannulation of arterial and venous (inferior mesenteric vein) system. Although the dual-flush technique appears to provide a more complete organ flush especially for liver and pancreas, there is currently no evidence on the superiority of dual over single flush. Surprisingly, only one randomized trial exists comparing both flush techniques [5]. But also, high-level evidence data on perfusion pressure, flow and volumes are currently not available in the literature. This emphasizes the need for additional large randomized trials in this area of organ procurement.

Optimal donor treatment before procurement is essential for conditioning of the donor to achieve the best possible donor organ protection before procurement. McKeown and Ball [6] review this important topic from the anesthesiologic and neurologic point of view. The early identification of potential donors allows early optimal donor management (ODM) so that the greatest number of organs can be procured and transplanted. One important element of ODM is hormonal resuscitation with thyroid supplementation for cardiovascular stability, steroid administration for anti-inflammatory treatment of brain death-mediated immune inflammatory events, and vasopressin for cardiovascular support and prevention of excessive fluid overload. The review provides catastrophic brain injury guidelines, which should be used to guide ODM to minimize the pre-preservation injury.

Brain death triggers immune inflammatory events that have negative effects on donor organs before procurement and after reperfusion at allograft implantation. Dziodzio *et al.* [7] review immune inflammatory mechanisms of brain death on IRI and highlight the potential role of

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immunosuppressive treatment in donors to target brain death-mediated proinflammatory organ injury. The deceased donor treatment with methylprednisolone [8], which is an essential element of ODM as reported by McKeown and Ball in this section [6], results in less IRI injury and decreases the incidence of acute rejection. There is growing evidence that inflammatory innate immune activation is a key player in the establishment of IRI after reperfusion. This type of sterile immune response is triggered by the sentinel pattern recognition receptor system [1]. There is growing evidence that T cells in particular $CD4^+$ are involved in the activation and regulation of the inflammatory immune response to IRI. This topic is highlighted in the review by Rao *et al.* [9]. The authors of this review state that a better understanding of T-cell biology in IRI is important for the development of T cell-specific treatments to ameliorate IRI.

Organ protection does not only apply to the donor, procurement and preservation but also to anesthetic strategies during and after the operation. Hovaguiman *et al.* [10] present a comprehensive review on this topic from the anesthesiologic point of view. The authors conducted a systematic review of the current literature of the years 2012 and 2013. Postoperative pain control, early extubation, adequate blood glucose control and strategies to reduce perioperative bleeding are associated with improved posttransplant outcome. Volatile anesthesia with seroflurane or inhaled nitric oxide are promising protective strategies against IRI directly before, during and after reperfusion of the allograft. The benefit of these anesthesiologic treatment strategies during transplantation is currently tested in randomized controlled trials.

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Conflicts of interest

There are no conflicts of interest.

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